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(54) A dynamic earth anchor, and a sleeve therefor

(57) A dynamic earth anchor comprises a plastics sleeve 10 for insertion into a borehole formed therefor in a terrestrial formation, and a rock bolt 16 for insertion into the sleeve for stabilising the formation. The sleeve is a hollow body having a conformation which facilitates either its installation into the borehole, or the insertion of the rock bolt thereinto. Additionally, in at least one embodiment thereof, the sleeve is shaped to accommodate the flow of a fluid, such as a grout, along its outer surface. In another embodiment, the sleeve has a knife edge (36) to rupture a grout cartridge installed in the borehole in advance of the sleeve.

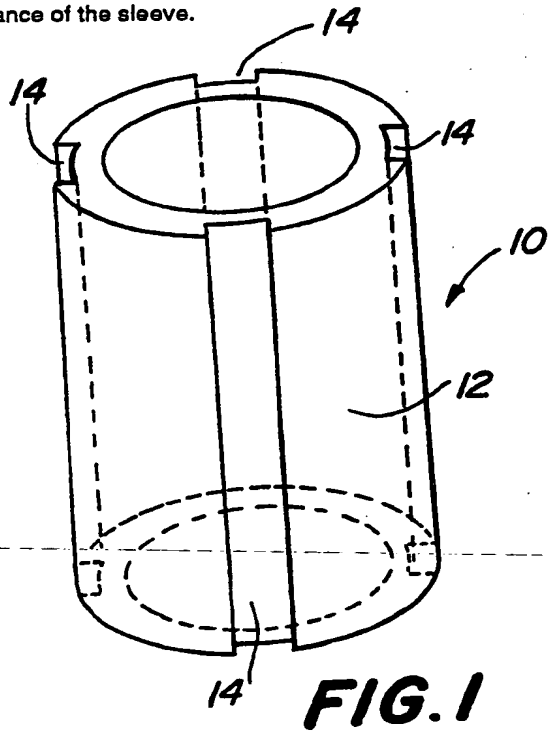

FIG. 1

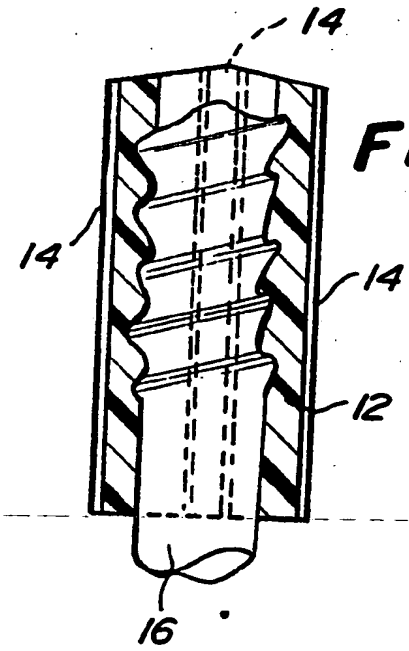

FIG. 2

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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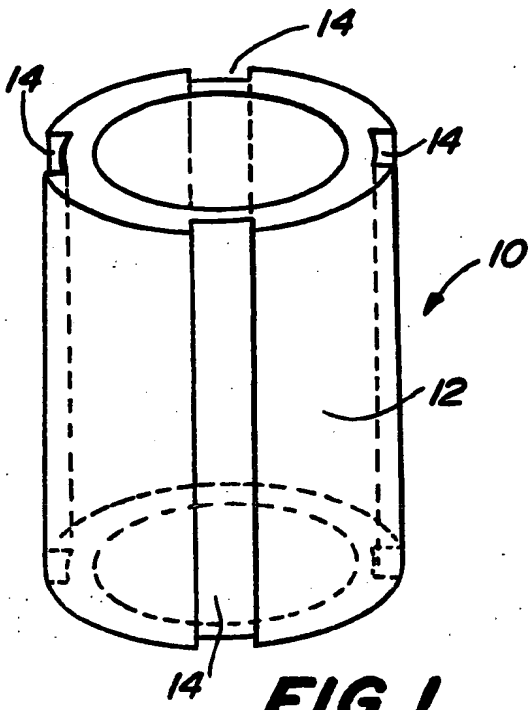

FIG. 1

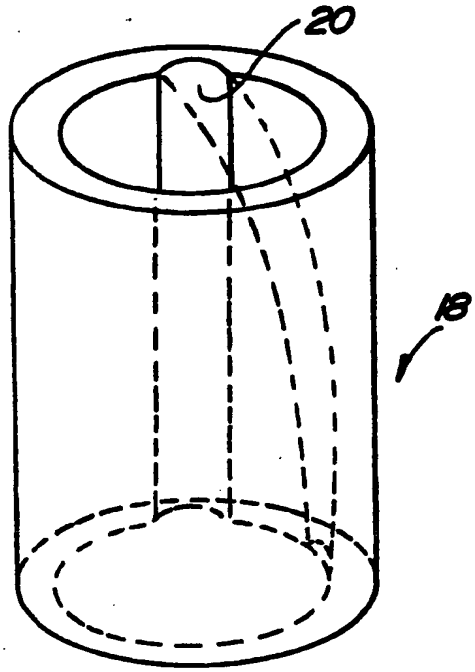

FIG. 3

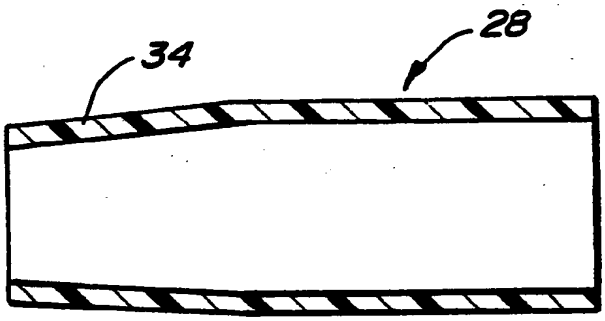

FIG. 5

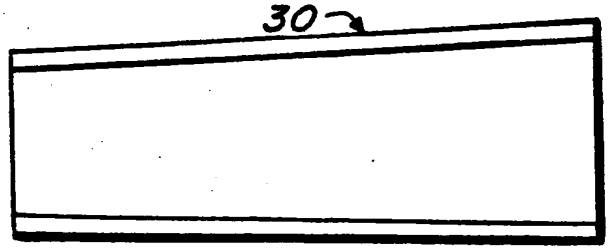

FIG. 6

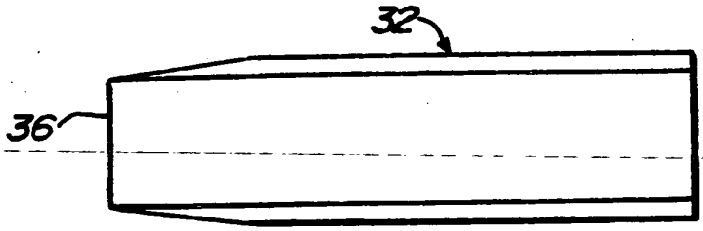

FIG. 7

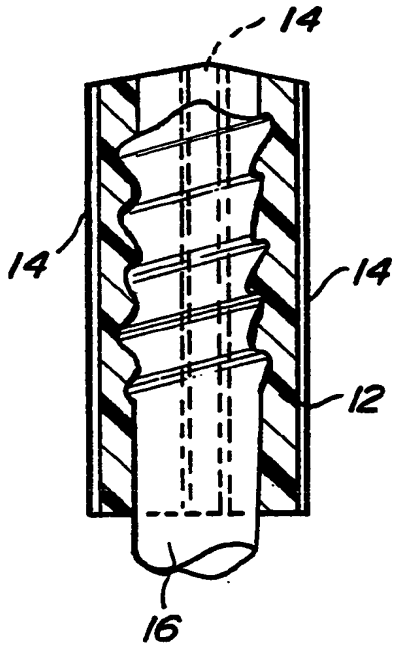

FIG 2

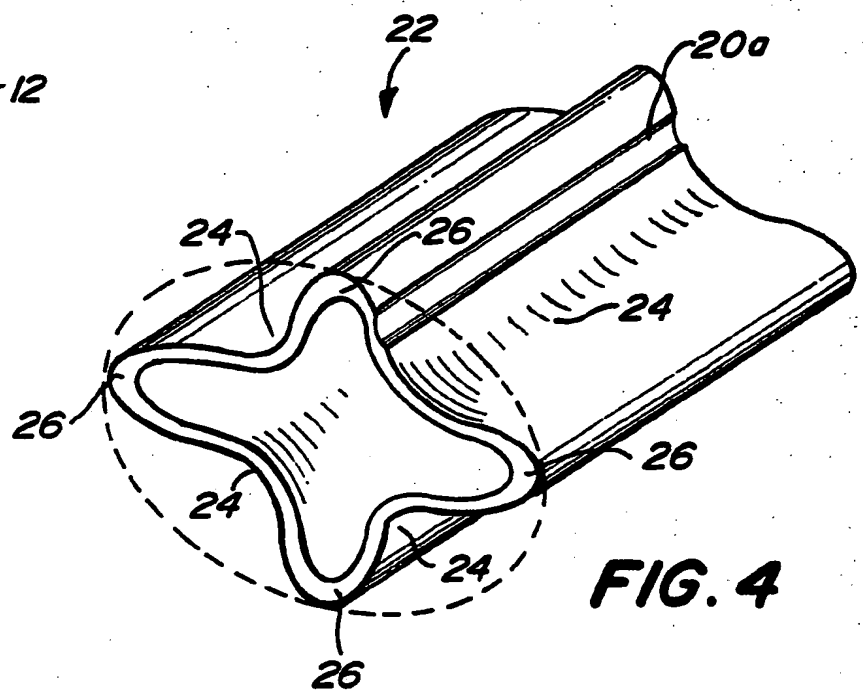

FIG. 4

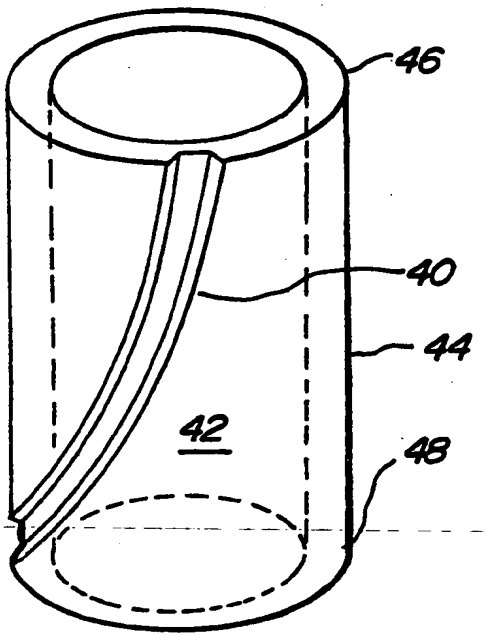

FIG. 8

A DYNAMIC EARTH ANCHOR, AND A SLEEVE THEREFOR

This invention pertains to dynamic earth anchors, or rock stabilising fixtures, as the same are also identified, and in particular to such earth anchor so conceived as to facilitate either the insertion of a rock bolt-receiving sleeve into the terrestrial formation borehole, or the insertion of the rock bolt into the sleeve, as well as to sleeves of and for such earth anchors.

Dynamic earth anchors, or rock stabilising fixtures, are well known. Exemplary thereof is the "Dynamic Rock Stabilising Fixture" set forth in the U.S. Patent No. Re 32645 and issued to James J. Scott.

The fixture in the aforesaid patent comprises a sleeve having a hollow body which is inserted into the end of a terrestrial borehole, and a rock bolt which is then inserted into the borehole-seated sleeve. Typically, the bolt will have threads or other disruptions on the surface thereof to enhance its fast engagement with the sleeve. The combination sets up an almost immediate restraint of the terrestrial formation, and accommodates a roof plate, or the like, at the formation face.

Due to discontinuities and/or asperities in the sleeve-receiving borehole, it is frequently difficult to set the sleeve into the termination of the borehole; too, difficulties are commonly encountered in inserting the rock bolt into the seated sleeve.

According to one aspect of the present invention, there is provided a sleeve for insertion into a terrestrial borehole, and insertion thereinto of a roof bolt, the sleeve comprising a hollow body defining an endless wall and being formed of deformable material and said wall being shaped to facilitate at least one of the aforesaid borehole and roof bolt insertions.

According to a second aspect of the present invention, there is provided a dynamic earth anchor for stabilising a terrestrial formation, including a roof bolt, and a sleeve for (a) insertion thereof into a terrestrial borehole, and (b) insertion thereinto of said roof bolt, said sleeve being essentially as defined in the preceding paragraph.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 is a perspective view of one form of a sleeve for insertion into a terrestrial borehole,

Figure 2 shows a leading end of a threaded roof bolt made fast in the sleeve of Figure 1,

Figure 3 is a perspective view of a second form of the sleeve,

Figure 4 is a perspective view of a third form of the sleeve,

Figures 5, 6 and 7 are longitudinal cross-sectional views of further forms of the sleeve, and

Figure 8 illustrates a channel spirally disposed along an elongate outer surface of the sleeve body.

As shown in Figure 1, a sleeve 10, according to this embodiment thereof, comprises a body 12 which is hollow, thereby defining an endless wall. The body is formed of a deformable plastics material, and has four, equally-spaced-apart channels 14 formed in the outer surface thereof. The outer diameter of the sleeve 10 is substantially identical to that of the borehole into which it is to be inserted, and the inside diameter thereof is smaller than the greatest outside diameter of the roof bolt or rock bolt which is to be inserted into the sleeve. (For the purposes of this disclosure, roof bolt and rock bolt will be used interchangeably, as they mean the same thing.) Clearly, it requires some reasonable force to get the leading end of a roof bolt fully inserted into the undersized sleeve 10. Consequently, to minimise the force required, the channels 14 are provided as yieldable portions of the sleeve 10 which can splay and widen, before the inserting roof bolt, to make bolt entry easier to accomplish. As represented in Figure 2, the roof bolt 16 has entered the sleeve 10 and the channels have spread to give it entry.

The sleeve of Figure 3 is an alternative embodiment in which there is but a single yieldable channel 20, and here the latter is formed in the inner surface of the sleeve.

Where the embodiments of Figures 1 to 3 depicted sleeves 10 and 18 configured to facilitate the entry of the roof bolt 16 thereinto, Figure 4 shows an embodiment of a sleeve 22 which is an overall, outermost dimension which is smaller than the diameter of the borehole into which it is to be inserted. This embodiment is set forth to facilitate the entry of the sleeve 22 into the borehole without undue difficulty. The borehole is represented by the dashed outline, and the sleeve 22, of a substantially cruciform shape, is somewhat collapsed. The flutes or depressions 24 obtaining between the lobes 26 will expand, upon the insertion of a roof bolt thereinto, and the sleeve 22 will assume a circular shape and be pressed firmly into the wall of the borehole. This embodiment may also include a channel 20a.

Figures 5, 6 and 7 show, in longitudinal cross-section, further embodiments of sleeves 28, 30, 32, respectively, which are configured to facilitate their entry into a borehole. Sleeve 28 has a tapered front or leading end 34. Sleeve 30 has a taper running the full length thereof, with the narrowest portion being at the leading end, i.e., the bore entry end, thereof. Sleeve 32 is similar to sleeve 28; it is tapered only at the leading end thereof. In addition, however, sleeve 32 has a knife edge 36 at the termination of the taper. This offers a particular advantage. Frequently, such sleeves used in dynamic earth anchors are grouted in place. To this end, a cartridge of grout is placed in the borehole in advance of the sleeve. The knife edge 36 of sleeve 32 will, when forced into the borehole, following the insertion of a cartridge of grout, rupture the grout cartridge, and permit the grout to flow.

Reverting to the sleeve 10, of Figure 1, and having remarked about the use of grout, it is to be noted that the channels 14 will also serve as conduits for the flow of the fluid grout along the length of the sleeve 10. Therefore, as required in the circumstances, sleeve 10 can be modified to incorporate a knife edge (such as 36 of sleeve 32), or sleeve 32 could be formed with channels (such as those in sleeve 10).

As a further possibility, Figure 8 illustrates a spirally disposed channel 40 formed to extend along an outer surface 42 of body 44. The channel 40 extends substantially between a first end 46 and a second end 48 of body 44. Also, in Figure 3, it is illustrated in dotted line, that the channel 20 can be spirally disposed along an inner surface of the sleeve 18.

CLAIMS:

1. A sleeve for insertion into a terrestrial borehole, and insertion thereinto of a roof bolt, the sleeve comprising a hollow body defining an endless wall and being formed of deformable material and said wall being shaped to facilitate at least one of the aforesaid borehole and roof bolt insertions.

2. A sleeve according to claim 1, wherein said wall has inner and outer surfaces; and at least one of said surfaces has a channel formed therein.

3. A sleeve according to claim 2, wherein said sleeve has a longitudinal axis and said channel is substantially axially disposed.

4. A sleeve according to claim 2, wherein said channel is formed to extend spirally along at least one of said surfaces, said channel extending substantially between a first and a second end of said sleeve.

5. A sleeve according to any one of the preceding claims, wherein said wall is cruciform in cross-section.

6. A sleeve according to any one of the preceding claims, wherein at least one portion of said wall is more yieldable to stress than another portion thereof.

7. A sleeve according to claim 1, wherein said wall has inner and outer surfaces and said outer surface has means for conducting fluid substances along said wall.

8. A sleeve according to any one of the preceding claims, wherein said body has a leading end and a trailing end, with respect to a terrestrial borehole, and one of said ends has a smaller, outer circumference than has the other of said ends.

9. A sleeve according to claim 8, wherein said body is substantially uniformly tapered from one of said ends to the other thereof.

10. A sleeve according to claim 8, wherein one of said ends defines a straight cylinder; and the other of said ends has a diminishing taper.

11. A sleeve according to claim 8, 9 or 10, wherein one of said ends terminates in a knife edge.

12. A sleeve for insertion into a terrestrial borehole, substantially as hereinbefore described with reference to any one of the embodiments shown in the accompanying drawings.

13. A dynamic earth anchor for stabilising a terrestrial formation, including a roof bolt, and a sleeve for (a) insertion thereof into a terrestrial borehole, and (b) insertion thereinto of said roof bolt, said sleeve being formed according to any one of the preceding claims.

14. A dynamic earth anchor according to claim 13, substantially as hereinbefore described with reference to any one of the embodiments shown in the accompanying drawings.

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